

Part II

SPECIFICATIONS FOR EQUIPMENT, SERVICES OF EXPERTS, AND TRAINING FACILITIES FOR INDIAN PERSONNEL FOR THE ESTABLISHMENT OF PILOT AND DEMONSTRATION FACILITY IN MATERIAL SYNTHESIS AT THE NATIONAL PHYSICAL LABORATORY, NEW DELHI (INDIA)

1. Project Requirements

The project requirements include

- A. Purchase of equipment as listed in Section 2,
- B. Foreign expertise to assist Indian personnel as detailed in Section 3,
- C. Training of N.P.L. scientists in research and development laboratories abroad as listed in Section 4.

2. Specifications of Equipment

The equipment is intended to be used to

- A. Make synthetic diamond, cubic boron nitride, and sintered diamond first on a laboratory scale and then on a batch production scale for consumer trials,
- B. Develop composite materials for use in extrusion dies and other high pressure tooling.

The equipment shall consist of

- A. 200 ton cubic press including all hydraulic and electrical systems, 3 sets of anvils (with  $\frac{1}{2}$  inch on edge square faces), and 3 sets of binding rings for these anvils and also including 100 each pyrophyllite sample cubes for use on 3 phase 440 volts or single phase 220 volts, 50 c/s electric supply,
- B. 24 sets of spare anvils,
- C. 24 sets of binding rings,
- D. 1,000 pyrophyllite sample cubes.

3. Services of Experts

The successful bidder shall arrange to provide experts to assist the Indian personnel in their research and development efforts to fulfill the objectives stated in Section 2. The qualifications and duties of the experts are detailed below:

A. 1 expert for 3 months

Qualifications: The expert should have basic qualifications in science or engineering with experience in the synthesis of materials using high-pressure high-temperature techniques.

Duties: The expert will assist the Indian personnel in determining the process parameters for the synthesis of crystalline diamond, sintered diamond and cubic boron nitride. He will also assist in the batch production of these materials for extensive consumer trials.

B. 1 expert for 3 months

Qualifications: The expert should have basic qualifications in science and engineering with experience in the synthesis and testing of composite materials.

Duties: The expert will assist the Indian personnel in determining the process parameters for the synthesis of various types of composite materials and investigating their use in extrusion tooling and other industrial applications.

4. Training Facilities

The successful bidder shall arrange the training for the scientists and engineers of the user organization at its own laboratory or at other research and development laboratories where such facilities exist. The details of training facilities required are given in the following table:

<u>S. No.</u>	<u>Number of Trainees</u>	<u>Total Man-Months</u>	<u>Fields of Training</u>
1.	1	3	Synthesis of crystalline and sintered diamond and cubic boron nitride.
2.	1	3	Synthesis of composite materials.

5. General Conditions

- A. The bidder may state whether he is prepared to supply equipment, expert services and training facilities required for the project. If, however, he is prepared to supply only part of the inputs, he may explicitly mention this in the quotations.
- B. The bidder shall undertake the erection and commissioning of the equipment and the costs shall be indicated in the quotations for the equipment. The satisfactory performance of the equipment shall be guaranteed for a two-year period from the date of commissioning. In case of unsatisfactory performance, the successful bidder shall carry out the necessary repairs at his own cost.

3.

- C. The bidder will indicate whether he is prepared to supply the spare and wear parts on a continuing basis.
- D. The bidder may indicate the delivery period for the equipment.
- E. The successful bidder will provide a layout sketch of the equipment and the type and size of building that will be necessary to house the unit.

LIST OF TYPICAL PRODUCTS FOR EXTRUSIONA. Aluminium Alloys

S.No.	Material	Size
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Solid Circular Sections

(All 10 metres long)

- |    |  |                |
|----|--|----------------|
| 1. | Alloy B26S<br>( Cu 4.3% , Si 0.8% ,<br>Mn 0.8% , Mg 0.8% ) | 40 mm diameter |
|----|--|----------------|

- |    |                  |                |
|----|------------------|----------------|
| 2. | Aluminium Bronze | 10 mm diameter |
|----|------------------|----------------|

Solid Rectangular Sections

(All 10 metres long)

- |    |  |   |
|----|--|---|
| 1. | Alloy B26S<br>( Cu 4.3% , Si 0.8% ,<br>Mn 0.8% , Mg 0.8% ) | (i) 40 mm x 20 mm<br>(ii) 50 mm x 20 mm |
|----|--|---|

- |    |                                     |   |
|----|-------------------------------------|---|
| 2. | Alloy A56S<br>( Mg 5.0% , Mn 0.3% ) | (i) 0.90 mm x 0.50 mm<br>(ii) 2.70 mm x 0.65 mm<br>(iii) 3.00 mm x 0.50 mm<br>(iv) 3.00 mm x 0.75 mm<br>(v) 3.20 mm x 0.80 mm<br>(vi) 4.20 mm x 1.00 mm |
|----|-------------------------------------|---|

Circular Tubing

(All 6 meters long)

- |    |                                  |   |
|----|----------------------------------|---|
| 1. | Alloy 2S<br>( Al 99.0% minimum ) | (i) 2.44 mm x 1.42 mm x 0.51 mm<br>(ii) 3.00 mm x 1.60 mm x 0.70 mm<br>(iii) 6.36 mm x 3.92 mm x 1.22 mm<br>(iv) 6.36 mm x 4.76 mm x 0.80 mm<br>(v) 7.94 mm x 5.40 mm x 1.27 mm |
|----|----------------------------------|---|

S.No.	Material	Size
2.	Alloy 3S ( Mn 1.2% )	28.73 mm x 27.31 mm x 0.71 mm
3.	Alloy A56S ( Mg 5.0% , Mn 0.3% )	(i) 29 mm x 24 mm x 2.5 mm (ii) 40 mm x 30 mm x 5 mm
4.	Alloy B51S ( Si 1.0% , Mg 0.6% , Mn 0.5% )	45 mm x 41 mm x 2 mm

B. Copper and Copper Alloys

S.No.	Material	Size
<u>Solid Circular Sections</u> (All 10 metres long)		
1.	Copper	(i) 1.35 mm dia (ii) 1.95 mm dia
<u>Solid Rectangular Sections</u> (All 10 metres long)		
1.	Copper ( Cu plus any Ag present minimum 99.9% , Phosphorus min 0.015% max 0.040% )	(i) 2.10 mm x 1.08 mm (ii) 3.05 mm x 1.25 mm (iii) 3.80 mm x 1.00 mm (iv) 6.90 mm x 3.50 mm (v) 7.40 mm x 2.10 mm (vi) 8.60 mm x 2.63 mm (vii) 9.30 mm x 4.70 mm
2.	Silver bearing copper	28 mm x 7 mm

S.No.	Material	Size
<u>Rectangular Tubing</u> (All 6 metres long)		
1.	Electrolytic copper ( ETP Grade )	(i) 7.4 mm x 5 mm x 1.5 mm (ii) 60 mm x 18 mm x 6 mm
<u>Circular Tubing</u> (All 6 metres long)		
1.	Copper ( Cu plus any Ag present min 99.9% Phosphorus min 0.015% max 0.040% )	(i) 0.225 in x 0.125 in x 0.050 in (ii) 0.235 in x 0.125 in x 0.055 in (iii) 0.245 in x 0.125 in x 0.060 in (iv) 0.191 in x 0.031 in x 0.080 in
2.	Copper ( Cu plus any Ag present min 99.9% Phosphorus min 0.015% max 0.040% )	(i) 0.25 in x 0.194 in x 0.028 in (ii) 2.25 in x 2.12 in x 0.065 in
3.	70/30 Arsenical Brass ( Cu between 70% and 73% As between 0.02% and 0.06% Zn the remainder )	(i) 1 in x 0.904 in x 0.048 in (ii) 0.75 in x 0.494 in x 0.128 in (iii) 1.75 in x 1.622 in x 0.064 in (iv) 2.00 in x 1.840 in x 0.080 in
4.	(i) 90/10 Copper - Nickel Alloy ( Ni between 10% and 11% Fe between 1% and 2% Mn between 0.50% and 1.00% Cu the remainder	(i) 16 mm x 14 mm x 1 mm (ii) 19 mm x 17.5 mm x 0.75 mm (iii) 19 mm x 17 mm x 1 mm (iv) 30 mm x 28 mm x 1 mm
	(ii) Admiralty Brass ( Cu between 70% and 73% Sn between 1% and 1.5% As between 0.02% and 0.06% Zn the remainder	

C. Stainless Steel

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S.No.	Material	Size
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Circular Tubing  
(All 6 metres long)

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|----|-----------------|---|
| 1. | Stainless steel | Inner diameter ranging<br>between 6 mm and 40 mm<br><br>Wall thickness ranging<br>between 0.5 mm and 3 mm |
|----|-----------------|---|